SFB/TRR 21 - Seminar

15. November 2012, Ulm

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Quantum phases of cold polar molecules in bilayers

Ultra-cold gases are highly controllable quantum systems. Lately attention has been focused on gases of polar atoms or molecules where the dipole-dipole interaction plays a significant role. A promising way towards a polar quantum degenerate gas is to confine it to thin, almost two-dimensional layers. We study theoretically a system of ultra-cold dipolar fermionic molecules in a bilayer geometry. The peculiar scattering properties in this setting are analyzed. Then we show that a state of Cooper-like pairs can form such that a molecule in layer 1 is paired with a molecule in layer 2. Varying the dipole leads to a transition from this BCS-pairing to a Bose-Einstein-Condensate of loosely bound dimers (BCS-BEC crossover). Additionally, we consider the non-equilibrium dynamics of a polar gas. Here the dipole interaction leads to state exchange collisions, whose influence on the dynamics can be observable at higher temperatures.

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